fifth embodiment, a wiring groove is formed on the surface of the base insulation film 102, the barrier metal 103 and Cu wire 104 are formed therein, and a structure shown in FIG. 5A is provided.

Next, as shown in FIG. 5B, a silicon nitride film 105 is formed on the surfaces of the base insulation film 102, barrier metal 103, and Cu wire 104, and a first semiconductor substrate 108 is formed.

Then, as shown in FIG. 5C, an interlayer insulation film 106 (polymethyl siloxane film) is formed on the surface of the silicon nitride film 105 by using the heating work and the electron beam irradiation work in combination as in the fifth embodiment, and a semiconductor device 109 is formed.

When the thus obtained semiconductor device 109 is observed by using an optical microscope, the oxidization of the surface of the Cu wire 104 is not observed.

In addition, while the steps 2 to 4 are executed, while steps up to the step of forming an interlayer insulation film 106 followed by these steps are executed, and after these steps have been completed, the release of the base insulation film 102 (polymethyl siloxane film), barrier metal 103, Cu wire 104, silicon nitride film 105, and interlayer insulation film 106 (polymethyl siloxane film) is not observed.

In addition, when the resistance value of the Cu

wire 104 is measured, the measurements were substantially equal to each other before and after forming the interlayer insulation film 106. Further, when a CMP process is applied to the interlayer insulation film 106, the release of the interlayer insulation film 106 did not occur.

In the present embodiment as well, advantageous effect similar to that according to the fifth embodiment is attained. Further, according to the present embodiment, a polymethyl siloxane film is used as the base insulation film 102, whereby the relative dielectric constant of the semiconductor device 109 can be reduced. That is, the wiring capacity of the semiconductor device 109 is reduced more significantly so that a product between a wiring resistance and an inter-wire capacity can be reduced. In this manner, an operating speed of the semiconductor device 109 and those of various devices using the semiconductor device 109 can be improved more significantly.

(Seventh Embodiment)

FIGS. 5A to 5C are a sectional view showing the steps of manufacturing a semiconductor device according to a seventh embodiment of the present invention. The present embodiment is different from the fifth embodiment in that a polymethyl siloxane film is used as a base insulation film 102, and the polymethyl siloxane film is formed by using a heating work and the

electron beam irradiation work in combination.

As shown in FIG. 5A, the base insulation film 102 is formed on a surface of a semiconductor substrate 101. In the present embodiment, a polymethyl siloxane film is formed as the base insulation film 102. The above method of forming the polymethyl siloxane film is formed by using the heating work and the electron beam irradiation work, as in the method of forming the polymethyl siloxane film as an interlayer insulation film 105 described in the fifth embodiment.

Subsequently, a wiring groove in its desired size and shape is formed at a predetermined part on the surface side of the base insulation film (polymethyl siloxane film) 102. Then, the inside of the above wiring groove is filled with the barrier metal 103 and Cu wire 104 in accordance with a conventional CMP process, and the surfaces of the polymethyl siloxane film 11, barrier metal 103, and Cu wire 104 are flattened.

Next, as shown in FIG. 5B, a silicon nitride film 105 is formed on the surfaces of the base insulation film 102, barrier metal 103, and Cu wire 104, as shown in FIG. 5B, and a first semiconductor substrate 21 is formed.

Next, as shown in FIG. 5C, a polymethyl siloxane film that is an interlayer insulation film 106 with its low dielectric rate is formed on the surface silicon